CLAIMS

WHAT IS CLAIMED IS:

1. A compression molding method for compressing a powder mixture to form a ring-like pellet comprising the steps of:

moving a center pin mounted in the axial center of a cylindrical die downwardly to locate lower than a top surface of the die;

filling an annular molding space defined between the die and the center pin with the powder mixture;

lifting up the center pin to a given molding position to define the annular molding space between the center pin and the die; and

compressing the powder mixture in the annular molding space from upper and lower sides with an upper plunger and a lower plunger.

2. A compression molding method according to claim 1, in which, after the powder mixture is supplied into the die, the center pin having a plane top surface is lifted up to a given molding position where the top surface of the center pin is flush with the top surface of the die so as to determine the annular molding space, and the powder mixture is then compressed.

3. A compression molding method according to claim 1, in which, after the powder mixture is supplied into the die, the center pin is lifted up to a given position where a top end thereof projects out from the top surface of the powder

mixture to determine the annular molding space, and the powder mixture is then compressed.

4. A compression molding method for compressing a powder mixture to form a ring-like pellet comprising the steps of:

filling an annular molding space defined between a cylindrical die and a center pin mounted in the axial center of the die with the powder mixture;

compressing the powder mixture from upper and lower sides with an upper plunger and a lower plunger;

lifting up the center pin together with the lower plunger to push the formed pellet upwardly to the outside, the pellet still being stuck to the center pin; and

removing the pellet from the center pin.

5. A compression molding method for compressing a powder mixture to form a ring-like pellet comprising the steps of:

moving a center pin mounted in the axial center of a cylindrical die downwardly to locate lower than a top surface of the die ;

supplying the powder mixture abundantly into an annular molding space defined between the die and the center pin;

lifting up the center pin to a given molding position where the annular molding space is defined;

removing an extra of the powder mixture to cause a given amount of the powder mixture corresponding to one pellet to

remain in the annular molding space or the die before or after the center pin is lifted up;

compressing the given amount of the powder mixture in the die from upper and lower sides with an upper plunger and a lower plunger;

lifting up the center pin together with the lower plunger to push the formed pellet upwardly to the outside, the pellet sill being stuck to the center pin; and

removing the pellet from the center pin.

6. A compression molding method according to claim 5, in which the center pin having a plane top surface is lifted up to a given molding position where the top surface of the center pin is flush with the top surface of the die, after the powder mixture is abundantly supplied into the annular molding space in the die.

7. A compression molding method according to claim 6, in which the extra of the powder mixture is removed by leveling the heap of the powder mixture along each top surface of the die and the center pin being flush with each other, so that the given amount of the powder mixture is remained in the annular molding space to be compressed.

8. A compression molding method according to claim 5, in which the powder mixture is supplied into the die in more than a required amount under a state that the center pin is located at a position lower than the top surface of the die by a given distance, and the extra of the powder mixture is removed by leveling the heap of the powder mixture along the

top surface of the die so as to cause the given amount of the powder mixture to remain in the die under a state that the top end of the center pin is positioned lower than the top surface of the die.

9. A compression molding method according to Claim 8, in which the lower plunger is lowered after the given amount of the powder mixture is measure out so as to cause the top surface of the powder mixture to sink to a lower position than the top surface of the die, and the upper plunger is descended to close an opening of the die at the top end thereof with the lower end of the upper plunger.

10. A compression molding method according to Claim 9, in which the center pin immersed in the powder mixture is vertically reciprocated while being lifted up to the given molding position where the top end thereof emerges from the top surface of the powder mixture and the annular molding space is defined by the center pin and the die.

11. A powder compression molding apparatus comprising:

a molding unit including a cylindrical die, a center pin disposed at the axial center of the die, and a lower plunger and an upper plunger for compressing a powder mixture supplied in an annular molding space defined between the die and the center pin, the lower plunger and the center pin being arranged to be movable in the axial direction in relation to each other as well as to the die, and

a controller for separately controlling actions of the lower plunger and the center pin.

12. A powder compression molding apparatus according to claim 11, further comprising:

a first lower plunger actuating cam means for driving the lower plunger to perform a compression molding action in the die;

a second lower plunger actuating cam means for allowing the lower plunger to move vertically in the die;

a third lower plunger actuating cam means for carrying out an ejecting operation to push the pellet upwardly out of the die; and

a center pin actuating cam means for moving the center pin upwardly to the molding position after being moved downwardly to locate lower than the top surface of the die and to perform the ejecting operation to push the pellet out of the die.

13. A powder compression molding apparatus according to claim 12, further comprising:

a lower lifting shaft, to the upper end of which the lower plunger is mounted and within which the center pin is coaxially disposed for relative sliding movements, the lower lifting shaft being provided with a first cam follower at a lower end thereof to engage with a lower pressure roller and with a second cam follower at a middle part thereof to engage with a lower plunger actuating cam; and

a third cam follower connected to the center pin to engage with the center pin actuating cam, whereby the lower pressure roller and the first cam follower constitute the

first lower plunger actuating cam means, the lower plunger actuating cam and the second cam follower constitute the second lower plunger actuating cam means, and the center pin actuating cams and the third cam follower constitute the center pin actuating cam means.

14. A powder compression molding apparatus according to claim 12, wherein the center pin actuating cam means comprises the center pin actuating cam having a cam surface only at a lower side thereof, the cam follower joined to the center pin and engaged with the cam surface of the center pin actuating cam, and a resilient member for constantly urging the center pin upwardly and detachably pressing the cam follower against the cam surface of the center pin actuating cam.

15. A powder compression molding apparatus according to claim 12, wherein the center pin actuating cam means is so constructed as to cause the center pin to vertically reciprocate more than once during the step of lifting up the center pin from its lowered position to the molding position.

16. A powder compression molding apparatus according to claim 15, wherein the center pin comprises an upper portion for defining the annular molding space with the die and a lower portion which is smaller in diameter than the upper portion, and a powder outlet space is provided between the lower portion of the center pin and the lower plunger.

17. A powder compression molding apparatus according to claim 11, wherein at least the outer side of the center pin

is not tapered to be a cylindrical shape, or both of the inner side of the die and the outer side of the center pin are not tapered.

18. A powder compression molding apparatus according to claim 11, wherein the center pin has a sharp end of a bullet-nose shape or a polygonal conical shape provided at the top end thereof.

19. A powder compression molding apparatus according to claim 11, wherein a plurality of the molding units are mounted at equal intervals on a circle about the center of rotation of a rotary disk.

20. A dry cell containing the powder mixture pellet which is formed to be of a ring-like shape by the compression molding method according to claim 5 and has an inner side or both inner and outer sides thereof not being tapered thus having a cylindrical configuration.

21. A dry cell of any types from R20 to R1 having one or two powder mixture pellets which are formed by the compression molding method according to claim 5 contained in a cell case.

22. A rotary type powder compression molding assembly system comprising:

a rotary disk;

a plurality of molding units for producing pellets from a powder mixture by compression molding mounted at equal intervals on a circle about the center of rotation of the rotary disk; and

an insertion assembly station mounted at an appropriate position on a movement path of the molding units for inserting the molded pellet into a case.

23. A rotary type powder compression molding assembly system according to claim 22, wherein a plurality of the insertion assembly stations are provided so that the pellets formed at each of the molding units located between the insertion assembly stations are inserted into the case immediately after the compression molding at the next insertion assembly stations.

24. A rotary type powder compression molding assembly system according to claim 23, wherein the insertion assembly station is provided in a pair, and further comprises:

a case carrying-in means for feeding the cases into one insertion assembly station, a series of case holding means for holding and conveying the cases loaded with the pellet to another insertion assembly station; and

a case carrying-out means for removing the cases after being loaded with the pellet at each insertion assembly station.

25. A rotary type powder compression molding assembly system according to claim 24, wherein each of the case holding means is mounted on the rotary disk corresponding to each molding unit and is constructed to hold and retract the case loaded with the pellet at the first insertion assembly station to its retracted position beside the molding unit,

and to advance the case to the movement path of the molding units at the next insertion assembly station.

26. A rotary type powder compression molding assembly system according to claim 22, wherein the molding unit comprises:

a substantially cylindrical die;

a center pin mounted in the axial center of the die; and

a lower plunger and an upper plunger for compressing the powder mixture supplied in an annular molding space defined between the die and the center pin, so that the pellet is assembled into the case by being pushed up into the case located coaxially above the die at the insertion assembly station by the action of both the lower plunger and the center pin and by lowering the center pin thereafter while the pellet is supported by the lower plunger.

27. A rotary type powder compression molding assembly system according to claim 24, wherein the case is held by a conveyor member, which is conveyed and positioned by the actions of the case carrying-in means, the case holding means, and the case carrying-out means.

28. A rotary type powder compression molding assembly system according to claim 24, wherein the case holding means is mounted to one end of an operating lever which is mounted on the rotary disk corresponding to each molding unit, the operating lever being rotatably connected to the rotary disk with a cam follower at the other end thereof engaged with a cam disposed coaxially with the rotary disk, the cam having a

retraction cam surface for holding the case holding means at its retracted position beside the molding unit and an operating cam surface for causing the case holding means to advance to and retract from the movement path of the molding unit.